

SOME LOWER CRETACEOUS FORAMINIFERA FROM BORES  
IN THE GREAT ARTESIAN BASIN, NORTHERN  
NEW SOUTH WALES.

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With Plate I.

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INTRODUCTION.

A systematic examination is being made of samples obtained from bores drilled by the Water Conservation and Irrigation Commission of New South Wales in the Artesian Basin in the northern part of the State. It is hoped that the results obtained will help in working out the stratigraphy of the area and ultimately will assist in the solution of problems associated with the occurrence of subsurface water in the Basin. Neither the surface nor subsurface sediments in this area have been examined for a microfauna, but megafossils, including pelecypoda and scaphopoda, have been recorded from the Milparinka-Tibooburra district. Kenny (1934) states that these fossils "furnish positive evidence of the Lower Cretaceous (Rolling Downs) age of the beds and of definite affinity with the Roma Series of Queensland".

Samples from eleven bores have been examined to date and of these, seven have been found to contain an interesting microfauna of Cretaceous age. These bores are on the following properties:

- W. R. Johnston's "Calooma", 4 miles south-east of Lila Springs and 30 miles north-north-west of Bourke.
- G. M. Taylor's, 3 miles south of Ford's Bridge, and about 40 miles north-west of Bourke.
- E. Langbien's Bullaroon Station, 30 miles north-east of Bourke.
- D. Murray's Goolgumble Station, 30 miles north-east of Bourke.
- A. Holmes's, near Ellaville, about 50 miles north-west of Bourke.
- Berawinnie Pastoral Co., Toorale Station, 50 miles west of Bourke.
- Borong No. 2 Bore, 40 miles north-east of Mungindi.

The foraminifera herein described are in the Commonwealth Palæontological Collection, Canberra. The drawings of the species have been prepared by Mr. F. Canavan, M.Sc., of the Mineral Resources Survey.

PREVIOUS REFERENCES TO AUSTRALIAN CRETACEOUS FORAMINIFERA.

Despite the fact that sediments of Cretaceous age are fairly extensively distributed throughout Australia, there has been little investigation of them for microfossils in recent years.

The earliest worker was the late Professor W. Howchin, who in 1884 published a paper on foraminifera from a bore at Hergott Springs (now Marree), 441 miles north of Adelaide, in the Artesian Basin in South Australia, but did not describe any of them until 1895. In 1894 he listed 56 Cretaceous foraminifera from bores he had examined in the Artesian Basin, including fragments of

"*Bigenerina nodosaria*" from a bore near Wilcannia. Howchin commented "the most remarkable feature in the Table is the unusual proportion of foraminifera with arenaceous tests, there being no less than twenty species belonging to this class out of a total of fifty-six". The same feature is present in the collection now under discussion. There seems little doubt that the foraminifera from northern New South Wales belong to the same horizon as the South Australian forms.

In 1907, Howchin listed Cretaceous foraminifera from Gingin, Western Australia. Many of these specimens were later described by the late Mr. F. Chapman (1917).

#### REMARKS ON THE PRESENT COLLECTION.

The microfossils recorded from the bores in northern New South Wales include foraminifera, radiolaria and ostracoda. They occur in grey, carbonaceous shales. The association, in W. R. Johnston's Bore, of Cretaceous foraminifera and of radiolaria belonging to the genera *Cenosphaera*, *Porodiscus* and *Dictyomitra*, is known also from bores put down in the North-west Basin, Western Australia. (Crespin, 1938.) Ostracoda are only occasionally present, the commonest form being a well-known Cretaceous species, *Cytheropteron concentricum*.

Foraminifera are common in certain bores, arenaceous forms, especially *Haplophragmoides* and *Trochammina*, being strongly developed. Unfortunately, the majority of the tests have suffered compression and distortion and perfect specimens are difficult to obtain. (Howchin (1884) commented on the "compression and consequent distortion" of the South Australian specimens.)

Eight new species are herein described and notes on previously described species are included. The new species are :

- Haplophragmoides chapmani*.
- Trochammina raggatti*.
- Trochammina parvula*.
- Spiroplectammina cushmani*.
- Marginulina subcretacea*.
- Lenticulina warregoensis*.
- Lenticulina gunderbookaensis*.
- Planulina cretacea*.

#### DESCRIPTION OF SPECIES.

##### Genus *Hyperamminoides* Cushman and Waters, 1928.

##### *Hyperamminoides* sp.

*Observations.* Fragments of *Hyperamminoides* sp. are present in two bores, but in no case is any specimen well enough preserved to permit specific determination. Howchin recorded *H. vagans* Brady, a recent species of universal distribution, from the Hergott Springs Bore, South Australia, but it is probable that the two are the same and represent a new species.

*Occurrence.* W. R. Johnston's Bore, at 800 feet and 825 feet; and in No. 2 Bore, Boronga, at 1,701 feet and 1,751 feet 6 inches.

##### Genus *Ammobaculites* Cushman, 1910.

##### *Ammobaculites australe* (Howchin) (Pl. I, Fig. 1).

*Haplophragmium* sp. Howchin, 1884, p. 86.

*Haplophragmium australis* Howchin Ms., 1894, p. 364; 1895, p. 198, Pl. x, figs. 12-13.

*Plesiotype.* Test small, compressed, early portion coiled, later uncoiled in a straight linear series, which alters slightly in shape from being flattened at

base of series to oval at terminal. Five chambers in coiled portion, excavated at umbilicus. Sutures fairly distinct. Sutures in uncoiled portion less distinct, making it difficult to determine number of chambers present. Wall coarsely arenaceous and rough, composed of large grains of clear quartz and a dark mineral. Aperture simple, central. Length of test, 1.15 mm.; diameter of coiled chambers, 0.7 mm.

*Observations.* There is little doubt that this specimen is referable to Howchin's species, which was described from No. 1 Bore, Hergott Springs, South Australia, at a depth between 100 and 200 feet. He records further specimens from No. 2 Bore at 50 feet. The present specimen is smaller than that of Howchin's, the type measuring 2.9 mm. in length. The sutural lines in the linear portion of the present specimen are less distinct, Howchin's specimen showing five chambers.

*A. australe* closely resembles *A. suberetacea* Cushman and Alexander (1930) from the Lower Cretaceous beds at Lake Worth, near Fort Worth, Texas.

*Occurrence.* Plesiotype (Comm. Pal. Coll. No. 249), W. R. Johnston's Bore at 925 feet. Also D. Murray's Bore at 231 feet; and G. M. Taylor's Bore at 425 feet.

### Genus *Haplophragmoides* Cushman, 1910.

*Haplophragmoides chapmani* sp. nov. (Pl. I, Figs. 2a, b, 3.)

*Holotype.* Test closely coiled, planispiral, compressed, deeply umbilicated, periphery rounded. Chambers distinct, 9 in last whorl. Sutures distinct, straight. Wall arenaceous, smooth, dark coloured. Diameter, 0.72 mm.; thickness, 0.29 mm.

*Paratype.* Test similar in structure to holotype, but larger, white in colour, and slightly distorted. Diameter, 0.86 mm.

*Observations.* *Haplophragmoides chapmani* is a common species in the samples from D. Murray's Bore, but, unfortunately, the majority of tests have been compressed and distorted. The striking features of the species, whether well preserved or distorted, are the very well marked and straight sutures and the pronounced umbilicus in all specimens. There is some variation in the size of the tests, the largest ones having a diameter of 1.2 mm.

Several species of *Haplophragmoides* are described from the Cretaceous of America, but they bear little resemblance to *H. chapmani*. This form is apparently similar to that recorded by Howchin from Hergott Springs as "(?) *Endothyra Bowmani*" for at first sight these two forms are similar in appearance.

This species has been named in honour of my esteemed predecessor as Commonwealth Palaeontologist, the late Mr. F. Chapman.

*Occurrence.* Holotype (Com. Pal. Coll. No. 250), D. Murray's Bore at 277 feet. Paratype (Comm. Pal. Coll. No. 251), same bore at 165 feet. Also in Murray's Bore at 103 feet, 128 feet and 327 feet; in Holmes's Bore at 750 feet; G. M. Taylor's Bore at 300 feet; and in No. 2 Bore, Boronga, at 1,503 feet and 1,651 feet.

### Genus *Spiroplectammina* Cushman, 1927.

*Spiroplectammina cushmani* sp. nov. (Pl. I, Fig. 7.)

*Holotype.* Test small, elongate, tapering with greatest width at apertural end; early chambers planispiral, later becoming biserial, the biserial portion making up the larger part of the test. Coiled portion consisting of small indistinct chambers. Five pairs of moderately inflated chambers in biserial part, with oblique, slightly depressed sutures. Wall finely arenaceous, white in colour.

Aperture narrow slit in inner margin of last formed chamber. Length of test, 0.78 mm.

*Observations.* *Spiroplectammina cushmani* is common in Murray's Bore at 103 and 125 feet, but the majority of specimens are broken or distorted. Its characters are distinct from any of the described species of *Spiroplectammina*. It bears a slight resemblance to *S. navarroana* Cushman (1932), described from the Cretaceous of Texas, in its inflated chambers in the biserial portion and in the small indistinct chambers in the coiled portion, but *S. cushmani* tapers more rapidly from the apertural end to the apex.

The species is named after Dr. J. A. Cushman, of the Cushman Laboratory for Foraminiferal Research, Sharon, Massachusetts.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 255), D. Murray's Bore at 103 feet. Other specimens are at 125, 190 and 327 feet.

### Genus *Trochammina* Parker and Jones, 1859.

#### *Trochammina raggatti* sp. nov. (Pl. I, Figs. 4a-c, 5.)

*Holotype.* Test very compressed, periphery lobulate, moderately acute; 6 chambers in last coil, distinct on dorsal surface, last chamber large and inflated, especially on ventral surface. Sutures distinct, straight. Surface moderately smooth. Chambers in early portion very small, increasing rapidly in size in adult portion. Wall finely arenaceous. Aperture on inner margin of last chamber extending on ventral surface from periphery almost to umbilicus. Colour chiefly brown except last chamber, which is white. Greatest diameter, 1.0 mm.; thickness, 0.29 mm.

*Paratype.* Test very compressed due to crushing, periphery lobulate, moderately acute, 6 chambers in last whorl, the last two being large and gently inflated. Chambers on dorsal side in early portion indistinct, sutures straight. On ventral side last chamber expanded, making flap over umbilicus. Aperture on inner margin of last chamber. Wall finely arenaceous, smooth, brown in colour. Diameter, 0.91 mm.

*Observations.* *Trochammina raggatti* is fairly common in the bores, especially in Murray's Bore, where specimens vary in size and in colour from white to brown. The majority of the tests have been compressed during sedimentation.

The species is comparable with *T. taylorana* Cushman, from Texas, in its compression, but the sutures in the former are straight and the last chamber is more inflated on the ventral surface. It differs from *T. diagonalis* (Carsey), a common species in the Cretaceous of America, in having straight sutures. The chambers in the early portion of *T. diagonalis* are less distinct and increase in size more rapidly than *T. raggatti*.

The species is named after the Director of the Mineral Resources Survey, Dr. H. G. Raggatt.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 252), Dr. Murray's Bore at 327 feet. Paratype (Comm. Pal. Coll. No. 253), same bore at 231 feet. Also at the following depths: 103, 165, 190, 265 and 277 feet; in Holmes's Bore at 750 feet; and G. M. Taylor's Bore at 275 feet.

#### *Trochammina parvula* sp. nov. (Pl. I, Figs. 6a-c.)

*Holotype.* Test small, inequilateral, periphery lobulate, rounded. Chambers inflated, 6 in final whorl, increasing rapidly in size. Last chamber large and rounded on both dorsal and ventral surfaces. Chambers in early portion, small and indistinct. Umbilicus on ventral surface. Aperture ventral on inner margin of last formed chamber. Diameter, 0.34 mm.

*Observations.* *T. parvula* is a very small species, and there is no Cretaceous form with which it can be compared. In shape it resembles the recent *T. inflata* Montagu, but the last chamber of *T. inflata* is much larger and more inflated.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 254), W. R. Johnston's Bore at 725 feet. Also found at 900 and 950 feet in that bore and in Murray's Bore at 265 feet.

Genus **Lagena** Walker and Jacob, 1798.

**Lagena apiculata** (Reuss).

*Colina apiculata* Reuss, 1851, p. 22, pl. i, fig. 1.

*Lagena apiculata* (Reuss) Chapman, 1917, pl. iii, fig. 24.

*Observations.* This species was originally described from the Cretaceous but its range extends up to Recent. One specimen is present in W. R. Johnston's Bore at 900 feet.

Genus **Lenticulina** Lamarck, 1804.

**Lenticulina gunderbookaensis** sp. nov. (Pl. I, Figs. 9a, b.)

*Holotype.* Test smooth, translucent, compressed, closely coiled, evolute, almost circular, periphery slightly keeled, sutures distinct, curved, slightly depressed. Nine chambers, increasing gently in size to final chamber. Aperture radiate but not prominent, at apex of apertural face. Length of test, 0.67 mm. breadth, 0.8 mm.

*Observations.* The flatness and circular character of the test of *Lenticulina gunderbookaensis* makes it distinct from any described species. It has been named after the County of Gunderbooka in which the bore is situated.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 257), W. R. Johnston's Bore at 725 feet. Another specimen is recorded from No. 2 Bore, Boronga, at 952 feet.

**Lenticulina warregoensis** sp. nov. (Pl. I, Figs. 8a, b.)

*Holotype.* Test medium size, slightly elongate, oval, translucent, smooth, periphery acute. Peripheral outline evenly curved but faintly angular in last chamber. Chambers 10, early one involute, rapidly becoming evolute and increasing in size. Sutures smooth, curved, especially in early portion, where they are close together. Aperture radiate and protruding. Length, 1.1 mm.; width, 0.75 mm.

*Observations.* *Lenticulina warregoensis* shows some resemblance to *L. gibba* in shape, but the chambers in the present species are more numerous and the last chamber is not so elongate. Howchin's form "*Cristellaria gibba*" from Hergott Springs Bore is possibly referable to this species.

Several specimens of *L. warregoensis* are recorded from W. R. Johnston's Bore but none are complete enough for figuring. All are smaller than the holotype. The species is named after the Warrego River, which runs close to the bore site.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 256), A. Holmes's Bore at 700 feet. Other specimens, Holmes's Bore at 400 feet; Johnston's Bore at 350, 400 and 575 feet; and in No. 2 Bore, Boronga, at 1,751 feet 6 inches.

Genus **Marginulina** d'Orbigny.

**Marginulina subcretacea** sp. nov. (Pl. I, Fig. 10.)

*Holotype.* Test elongate, earliest portion slightly coiled, rapidly uncoiling. Seven chambers in adult stage. Early portion slightly compressed, later

chambers becoming inflated, the last chamber, which has lost outer wall, being almost circular in section. Sutures distinct and slightly oblique. Wall ornamented with fine longitudinal costæ, except in earlier portion, which is smooth. Aperture radiate, in outer margin of last chamber. Length of test, 2.9 mm.

*Observations.* *Marginulina subcretacea* is represented by a single specimen. No close comparison can be made with any described Cretaceous species. The nearest form is *M. navarroana* Cushman (1937), described from Alabama, but it differs from it in the twisted character of the costæ in the earliest portion of the American species. *M. subcretacea* also bears some resemblance to the Recent and Tertiary species *M. costata* but the costæ are finer in the Cretaceous form and the test rounder.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 258), A. Holmes's Bore at 450 feet.

#### *Marginulina bullata* Reuss.

*Marginulina bullata* Reuss, 1845-1846, Pt. 1, p. 29, pl. xiii, figs. 34-38. Cushman and Jarvis, 1928, p. 96, pl. xiv, figs. 7, 8.

*Observations.* Specimens of this widely distributed Cretaceous species are recorded from W. R. Johnston's Bore at the depth of 825 feet, and from G. M. Taylor's Bore at 275 feet.

#### *Marginulina ensis* Reuss.

*Marginulina ensis* Reuss, 1845-46, p. 29, pl. xii, fig. 13; pl. 13, figs. 25, 27.

*Hemicristellaria ensis* (Reuss) Plummer, 1931, p. 146, pl. x, figs. 1-4.

*Marginulina ensis* (Reuss) Cushman, 1937, pl. xiv, figs. 23-25.

*Observations.* One fairly typical specimen of this well known Cretaceous form is present in W. R. Johnston's Bore, at the depth of 1,075 feet. It has also been recorded from the Upper Cretaceous beds of Western Australia.

#### Genus *Anomalina* d'Orbigny, 1826.

##### *Anomalina rubiginosa* Cushman.

*Anomalina rubiginosa* Cushman, 1926, p. 607, pl. xxi, figs. 6a-c; 1940, p. 31, pl. vi, figs. 1-3.

*Observations.* *Anomalina rubiginosa* described from the Velasco shale of Mexico, is a common Cretaceous species and several good specimens are present in Johnston's Bore. In the New South Wales specimens, the periphery is broadly rounded and the walls of the test perforate, especially on the ventral surface.

*Occurrence.* Johnston's Bore at 400, 425, 520, 725 and 750 feet, and G. M. Taylor's Bore at 325 feet.

#### Genus *Planulina* d'Orbigny, 1826.

##### *Planulina cretacea* sp. nov. (Pl. I, Figs. 11a, b, 12a, b.)

*Holotype.* Test planispiral, dorsal face gently rounded, ventral face concave with small umbilicus. Periphery rounded. Six chambers in final whorl, gradually increasing in size and finely punctate. Sutures depressed, curved. Ventral surface of last chamber large and slightly inflated with aperture near margin. Diameter, 0.40 mm.

*Paratype.* Test similar in character to holotype but the test is larger with the last chamber showing strong inflation on the ventral surface. Diameter, 0.49 mm.

*Observations.* *Planulina cretacea* differs from *P. correcta* (Carsey), described from the Navarro beds in Texas, in its more evenly circular outline and more inflated chambers on the ventral surface. Several tests are present in W. R. Johnston's Bore. *P. cretacea* is most probably the species referred to by Howchin as "*Pulvinulina elegans*" from Hergott Springs.

*Occurrence.* Holotype (Comm. Pal. Coll. No. 259), W. R. Johnston's Bore at 450 feet. Paratype (Comm. Pal. Coll. No. 260), W. R. Johnston's Bore at 400 feet. Also in this bore from 325 and 575 feet.

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## EXPLANATION OF PLATE

- Fig. 1.—*Ammobaculites australe* (Howchin). W. R. Johnston's Bore, 925 feet. Plesiotype.  $\times 30$ .
- Fig. 2.—*Haplophragmoides chapmani* sp. nov. D. Murray's Bore, 277 feet. Holotype. (a) Side view; (b) apertural view.  $\times 30$ .
- Fig. 3.—*H. chapmani* sp. nov. D. Murray's Bore at 165 feet. Paratype.  $\times 30$ .
- Fig. 4.—*Trochammina raggatti* sp. nov. D. Murray's Bore, 327 feet. Holotype. (a) Dorsal; (b) apertural; (c) ventral.  $\times 30$ .
- Fig. 5.—*T. raggatti* sp. nov. D. Murray's Bore, 231 feet. Paratype. Dorsal view.  $\times 30$ .
- Fig. 6.—*Trochammina parvula* sp. nov. W. R. Johnston's Bore, 725 feet. Holotype. (a) Dorsal; (b) apertural; (c) ventral.  $\times 60$ .
- Fig. 7.—*Spiroplectammina cushmani* sp. nov. D. Murray's Bore, 103 feet. Holotype.  $\times 30$ .
- Fig. 8.—*Lenticulina warregoensis* sp. nov. A. Holmes's Bore, 700 feet. Holotype. (a) Side view; (b) apertural.  $\times 30$ .
- Fig. 9.—*Lenticulina gunderbookaensis* sp. nov. W. R. Johnston's Bore, 725 feet. (a) Side view; (b) apertural.  $\times 60$ .
- Fig. 10.—*Marginulina subcretacea* sp. nov. A. Holmes's Bore, 450 feet. Holotype.  $\times 15$ .
- Fig. 11.—*Planulina cretacea* sp. nov. W. R. Johnston's Bore, 450 feet. Holotype. (a) Dorsal; (b) apertural.  $\times 60$ .
- Fig. 12.—*P. cretacea* sp. nov. W. R. Johnston's Bore, 400 feet. Paratype. (a) Dorsal; (b) apertural.  $\times 60$ .



